The value of designers' creative practice within complex collaborations

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This paper reports a case study investigating the productive value of designers' creative practice *within complex academic-industrial collaborations in which a designer's practice had a formative role. Adopting a pragmatic approach, collaborators' experiences of this project were reconstructed through interviews and 'annotated timelines.' Collaborators were found to value the designer's work in responding to their particular concerns whilst also opening up new possibilities. This paper discusses how such benefit is attributable to the* 'designerly thinking' *of skilled designers, shifting the focus of work from problem-solving to problematisation and enabling participants to collectively formulate concerns, roles, and potentialities. The paper concludes that* designers' creative practice *can enable collaborative projects to build upon and transcend participants' expertise and expectations through 'creative exchange.'*

Keywords: design practice, design epistemology, participatory design, reflective practice, case study/studies

Collaborative projects are often rendered complex and challenging to undertake by the need to connect activities, foster interdisciplinary dialogue, and reconcile multiple agencies and concerns. Whilst involving collaborators who are untrained in design in creative activities can be a means of addressing these kinds of challenges, particularly in projects' early stages (Sanders & Stappers, 2008), this paper examines the value that *designers*' creative practice can hold for their collaborators through an empirical study of 'On the Precipice', a complex collaborative project in which creative practice enabled progress.

The importance of participation in design projects is widely studied and argued for (Vines, Clarke, Wright, McCarthy, & Olivier, 2013). For example, participation and influence by those likely to be affected by what is designed may satisfy their democratic rights and, in turn, better fit their practices and concerns (Carroll & Rosson, 2007; Ehn, 1993; Iversen, Halskov, & Leong,

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2012). However, there are also characteristics of skilled designers' practices that enable such projects to deliver successful outcomes. Numerous scholarly accounts claim that successful designers do tend to think and act in similar and particular ways, and propose models of such practice (Cross, 2007; Dalsgaard, 2014; Lawson, 1997; Schön, 1983). A common characteristic of such 'designerly thinking' (Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013) is the role of making as *inquiry* rather than simply the realisation of preformed ideas.

Some writers (e.g. Dorst, 2011; Kolko, 2010) have used philosopher C.S. Peirce's concept of *abduction* to distinguish the mode of reasoning employed by designers from the inductive and deductive modes typical in everyday use. Accepting Gaver's (2012) caution that theoretical descriptions can underspecify design, such accounts of the "logic of what might be" (Martin quoted in Kolko, 2010) nevertheless draw attention to the importance of making functioning as *analysis and synthesis* (Gedenryd, 1998; Schön, 1983). Ingold (2013) extends this principle to a broad range of practices where making becomes an "art of inquiry [where] the conduct of thought goes along with, and continually answers to, the fluxes and flows of the materials with which we work" (Ingold, 2013, p 6). These accounts owe much to pragmatist philosophy (Dewey & McDermott, 1981); and, guided by pragmatism, Dalsgaard (2014) describes inquiring making as the development of situated knowing to operationalise an always emergent, never fully finalised world.

In the case presented herein, an experienced designer contributed to a collaborative project as part of her PhD research. Whilst creative practice can contribute towards or be the means of research (Archer, 1995; Frayling, 1994), in what follows we consider the value of creative practice *as a pragmatic inquiry into what might be* irrespective of whether this practice constitutes academic research. Indeed, approaches currently discussed as research through design (Gaver, 2012; Zimmerman, Stolterman, & Forlizzi, 2010) depend upon this 'designerly' quality of the practice within them – or 'makerly' if, like Frayling, Archer and Ingold, we consider artists, designers and other makers collectively. Such making is then of any artefact that serves an ongoing makerly inquiry (sketches, mock-ups, scenarios) in addition to the crafting of final designs.

On the Precipice (Nissen, Bowers, Wright, Hook, & Newell, 2014) was a six-month project investigating how digital technology could express audience experience, bringing together academic and industry partners and an experienced designer (who created all of the artefacts within the inquiry). The project was amongst several in a larger research programme, the Creative Exchange, investigating constructive collaboration with arts and humanities academics and small to medium enterprises (SMEs) in the creative industries.

The latter provided a practical impetus for an empirical case study of *On the Precipice* to understand how such collaborative projects deliver value to those involved.

Evaluating the benefits of design participation is of concern for the design research community and recent studies have used participants' accounts to discuss the efficacy of co-design projects more broadly (Bossen, Dindler, & Iversen, 2010, 2012; Bowen, McSeveny, Lockley, & Dearden, 2013). Our focus in this paper is more specifically to report on our case study and, through a pragmatic lens (Dewey & McDermott, 1981), analyse and discuss the value of designers' *creative practice* within collaborative projects. Here, we do not attempt to unpack designerly thinking (c.f. Dalsgaard, 2014; Johansson-Sköldberg et al., 2013), rather provide evidence of how designers' creative practice holds value for partners within a complex collaboration.

The paper intends two contributions to design research. Firstly, in studying *On the Precipice*, we offer a rich, qualitative account of a design project, focussing on how creative practice explored the opportunities and challenges presented and enabled progress, and on the value that collaborators derived from such practice. Secondly, we use our empirical findings to discuss how creative practice can be productively situated within a complex collaborative context; how this demonstrates the particular value of designerly thinking in academic-industry collaborations; and, how such 'creative exchange' is a legitimate means of bringing participants into constructive dialogue.

We begin with a review of extant work that has motivated and informed our study, followed by an overview of the research programme within which it was conducted.

1 Background

1.1 Creative design practice in participative projects

Many discussions of the designer's role in participative projects have focussed on 'designer as facilitator,' emphasising the aptitudes and activities required to sensitively ensure democratic and productive participation, e.g. (Light & Akama, 2012). Whilst this remains important, designers' creative practice itself also requires consideration, and creative practice's role within complex collaborations arguably remains underexplored (Swan, Tanase, & Taylor, 2010; Wolf, Rode, Sussman, & Kellogg, 2006).

Steen (2013) discusses the virtues required for participatory design (PD) practitioners including cooperation, emancipation and reflexivity – familiar themes in the PD literature. He further discusses *cooperative curiosity* – "being open and receptive towards other people and their experiences, and towards

one's own experiences and learning" (p 953), and *cooperative creativity* – "jointly generating ideas, combining ideas of different people, and of practically realizing ('making real') products or services" (p 954). These virtues emphasize dispositions toward cooperative inquiry and design that highlight the *designer's creativity* and open-mindedness whilst not necessarily prescribing collective creative practice.

In discussing roles for designers in co-design projects, Lee (2008) observes that "the aesthetic element of design […] is still the core knowledge of the design professions, but is not being further developed and involved in the discourse of Design Participation" (p 32), and offers a new role for designers as "design generators […] working in the realm of collaboration to facilitate the mixing of 'abstract' experts and 'concrete' people [and] to *transform the way professionals work by inserting more creative design thinking*" (p 45, our *emphasis*).

Ehn and Badham (2002) discuss collective design as involving "politics in practice" that extends beyond "simplistic 'espoused theory' of democratic participation" to include the practical reality of "getting things done". Designers, as those skilled in effecting practical change, then have much to offer such work. Ehn & Badham's discussion, like Steen's, characterises a disposition that designers' should bring to their creative practice as "speculative propositions enacted as anxious acts of political love" (Ehn & Badham, 2002).

What remains underexplored is *creative practice* and *designerly thinking* as means of knowledge sharing within complex processes of inquiry involving multiple stakeholders. In *On the Precipice*, the doctoral researcher's *creative practice* was at the centre of a broader collaborative design process. As we shall elucidate, designing and making became valuable vehicles for collaboration in terms of sharing and developing understanding between those involved.

1.2 Case study background: The Creative Exchange (CX)

The four-year Creative Exchange (CX) research programme was undertaken through collaborations between SMEs, academics and creative practitioners undertaking doctoral research – a typical complex context. To enable participation in CX, funding was made available to pay industry participants for activities outside their normal remit (i.e. research) and to release academics from other responsibilities. These projects were expected to complete in about six months and incorporate an element of digital making that would produce tangible outputs relating to the project's focus of inquiry. Projects were formed at several 'Lab' events, where groups of PhD students, industry partners, and academic partners proposed project ideas in response to themes previously identified as of relevance to creative industries, and to the research programme itself.

2 *Case study:* On the Precipice

At a February 2013 Lab representatives from two arts organisations, a digital media academic and a PhD student collectively proposed a project to explore means of digitally capturing and using audience's experiences of art exhibitions. ISIS Arts are a visual and media arts organisation with an aim to engage new audiences with contemporary media art including the use of an inflatable, mobile exhibition space (nicknamed *The Big M*) that they use to stage 'pop-up exhibitions' in outdoor public spaces (Figure 1). The principal participant from ISIS Arts was CG, the project coordinator, although other members of the organisation occasionally participated. The second organisation, Modular, is run by EC, an artist and curator with particular interest and expertise in the use of technology within artistic practice. CN was the academic partner on the project, bringing research interests in digital media, HCI and performance. BN is a designer who had run her own professional design consultancy for several years, and was a PhD candidate at the time of our study. BN's design work has been exhibited internationally and her research explored implications of 3D printing technology for engagement, personalisation and shared meaning making. BN's main PhD supervisor JB joined the project two months after the Lab, and contributed an academic perspective on the value of making from his extensive professional art and design practice.

Following the Lab, the proposal developed into a collaborative project that took place between April and September 2013. Early stages involved discussions between the partners to define the aims and scope of the project, from which a *Big M* pop-up exhibition became the main context for the project. ISIS Arts had scheduled this exhibition prior to the project's formation, which consisted of a video artwork entitled *On the Precipice* (from which the project took its name, henceforth *the artwork*) playing in a 1-h loop within *The Big M*.

Work on this project focussed on the exploratory design and deployment of a digital system for capturing and expressing the visitors' responses to *the artwork* led by BN in consultation with the other partners. This involved partners visiting *Big M* pop-up exhibitions, and responding to them. The design and development process progressed through conversations with partners on emerging ideas and evaluating prototypes with exhibition visitors. The resulting system translated visitors' responses to *the artwork* into one of three different physical souvenirs (described in (Nissen et al., 2014)). Throughout the project, BN regularly discussed her research and design practice within and beyond the project with her supervisory team.

2.1 *Reconstructing and analysing* On the Precipice

Careful consideration was given to how we could study and analyse the role of creative practice in the *On the Precipice* project from key participants directly

Figure 1 The Big M – *ISIS Arts' mobile exhibition space*

involved in the collaborative work. Given that neither the first or second author were involved, we sought to capture *post-hoc* accounts from those who were, and developed a visual method of making 'annotated timelines' to elicit participants' reflections on their project experiences.

Adopting a qualitative, pragmatic methodology to inquiry (Dewey & McDermott, 1981), we conducted semi-structured interviews with individual project members, at which participants recounted their experiences of the collaboration whilst a timeline of project activities was drawn on a large sheet of paper. Participants were invited to annotate individual activities with related design ideas/decisions, learning, expectations, and effects on relationships between participants (see Figure 2). Once these timelines were completed, we asked our participants to identify and elaborate their account of two *defining moments* that shaped the project. All interviews were around 2-h in duration and video recorded.

Our intention through co-creating annotated timelines in the interviews about *On the Precipice* was to provide visual communicative means for people to actively *re-construct* their experiences of the project, rather than simply recollect them, in dialogue with the researchers. Only one of the participants co-created a timeline; we primarily drew the others in conversation with participants. However all four participants used the developing timeline to account for and reflect on the project (e.g. by gesturing to sections, and relating activities). Herein we do not present a detailed analysis of the timelines per se. Rather, we describe their significant methodological function in fostering conversations between researchers and participants. Transcripts of these conversations form a principal data set in the corpus.

We initially used thematic analysis (Braun & Clarke, 2006) to understand the challenges and opportunities *On the Precipice* presented to support CX's objective of devising methods and tools for academic-industry collaboration.

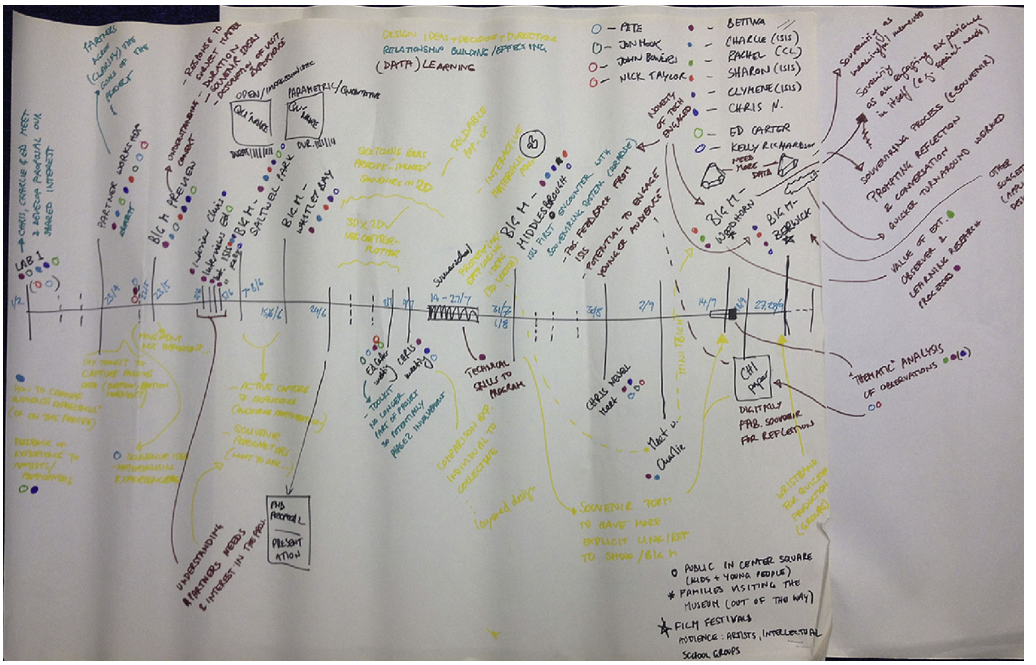

Figure 2 BN's annotated timeline

Following an inductive approach, Author 1 used Saturate[1] to code all four transcripts, Author 2 then blind-coded a section of one transcript and compared codes with Author 1 to provide a sample check. We then combined and collectively analysed codes to create a set of initial themes, returning to interview transcripts to ground and recontextualise our emerging insights.

From this initial analysis we felt that BN's creative practice, although continually noted by collaborators as an essential element of the project, was not sufficiently unpacked in the accounts elicited by the timelines. Accordingly we conducted another 2-h interview with BN and JB to generate a more detailed account of the organisation of creative work and its relationship to the overall project context. BN and JB referred to notebooks and sketchbooks at interview that provided a resource for reconstructing the events and sense making of their design activities (whilst also being documents of the work itself). Recognising this, we let BN's and JB's accounts flow from their notes and sketches. Being responsive in this way, we better understood how numerous threads of concern emerged and were developed through design practice.

3 *Findings*

We structure our findings in two sections: a description of how BN's design work responded to the context and explored novel possibilities; and participants' accounts of their benefits from this approach. Firstly, we summarise

events through which the project and the creative practice within it were configured within a complex collaboration.

3.1 Creative practice in a complex collaboration

3.1.1 Phasing the design work

All partners had pre-existing relationships with our research group and the University prior to their participation in CX, which led industry partners to expect that collaborative projects would include access to the group's design and technological resources and expertise, e.g. "*perhaps we could work with […] some of the technologists to develop [The Big M] and create a more immersive environment*" (CG). However, these initial formulations of role and responsibility were problematized at the February Lab event when the academic and industry partners were grouped according to a seemingly shared interest in audience experience, whereas particular inflections became apparent during group discussions. ISIS Arts' interests related to capturing audience experience for evaluation and development:

> "We needed to demonstrate whether we'd actually been successful in attracting this target audience […] I guess that was the starting point for the involvement of CX, of how can we start to capture our audience experience […] almost without them knowing?" CG

EC's particular interest stemmed from conversations with our research group four years previously about "*doing something in digital public space which … was tangible and controllable so that you could actually do some real world analysis of the actual real world impacts of interactive work in the public space*." For EC, such work would be an alternative to survey-based, post-hoc audience evaluation techniques, and explore the potential of interactive technology to monitor audience behaviour passively.

The nascent group's project proposal around audience experience secured funding and the group proposed to accommodate the differences between ISIS Arts' and EC's particular interests through dividing the project into two phases. In this way, project phasing emerged as a means to organise and pattern the different participants' varied concerns, roles and contributions.

3.1.2 Tensions in scoping design work

Tensions between partners' interests emerged as the two phases were planned. Partners agreed that the first phase would be based around *The Big M*, which imposed certain conditions that precluded EC's interests in artworks responding to audience behaviour: "*[ISIS Arts] want to measure the experience that people are gaining from that programme in The Big M. Whereas [EC] was interested in the audience actually generating the experience*" (CG).

In their timeline interviews, CG and EC both selected an April partners' meeting as a *defining moment*, where discussions focussed on 'what' audience behaviour or experience might be captured at *The Big M* and 'how', with a view to using this as an input to a second phase, e.g. developing "*a DIY toolkit to capture audience experiences*" (BN). On his timeline, EC annotated DIY toolkits as a positive potential outcome explaining that they were "*something you could give back to the [arts] community*, *an open source*, *very simple but hardened software. […] I was thinking that at least then there would be something to take onto this second stage*." Although EC seems optimistic here, subsequent activities focussed principally on *The Big M* and in his account he went on to reflect: "*None of [my ideas] were obviously incorporated. […] That obviously wasn't really the intention*, *it was more about reinterpreting evaluation data*."

At interview, JB recalled questioning proposals made at this meeting to track audience movement in enclosed environments like *The Big M* and presented work that he had been involved in ten years' previously. JB was also concerned that pursuing this line would not provide the necessary novelty for BN's doctoral research.

Reflecting on the whole project, EC suggested: "*we should've drawn the line at that [Lab] saying*, '*These aren't the same things*,' *I guess we were talking into it with phase one and phase two*" and annotated the lab event (as another defining moment) with "*design projects grouped for convenience*, *didn't feel like logical coupling*."

It is clear from these accounts that EC formulated a version of the unfolding project in which he could not have a productive role. He did not see a way of integrating the phases and, when looking back on the project, felt that his interests did not match the project's 'real intention'.

3.1.3 Building (some) group cohesion

Attending a preview of *the artwork* in *The Big M* served to clarify and focus phase one of the project for participants:

> "We had a very clear sense of what the canvas was that we were actually going to paint upon […] once you actually went in and experienced [The Big M] properly – so you went into the darkened bubbly chamber, heard the noise of the machines, the fans […] felt the cold, saw the audiences waiting to go in, saw the [urban] space that The Big M actually occupied" (CN)

This activity clarified aspects of the design brief but also reduced the potential to provide useful tools and data for the second phase. For example, the confined space of *The Big M* would produce limited movement data. This, and increasing time spent on the practical challenges and opportunities

presented by *The Big M*, reduced the likelihood of a phase 2 within the project timescale. Although this led to EC's withdrawal, CN cites the preview event as instrumental in building rapport with ISIS Arts and BN: "*I got to know [CG] reasonably well, […] we understood each other. I knew what her role was, she knew where I was coming from, I knew where [BN] was coming from*" (CN).

So, the actual experience of *The Big M* decisively shaped expectations as to what was possible. Specifically, early proposals of using movement data were less salient.

3.1.4 An emerging space for creative practice

During these early stages of the project, CN "*felt that [BN's] voice wasn't being really taken on board*," and JB recalled that this marginalisation of BN's voice could also jeopardise her opportunities for conducting valid doctoral research. The decision to focus on *The Big M* meant that research activities had to fit within a four-month programme commencing two weeks after the preview event. This gave a non-negotiable organisation to the project's work, which was then structured around this programme rather than explicit attention to phases one and two. BN led on this practical work to ensure that artefacts were produced in time for the five fixed showings of *the artwork* and, through iterative development of these artefacts, make progress in the project.

Considering these early stages of the project it is noticeable how the participants configure and reconfigure their interests, roles, responsibilities and involvement, including the collaborative relationships they will enter into, how the research is planned to unfold, and what specifically might get made. These are all concerns that interpenetrate and mutually shape each other with no single concern being uniformly dominant throughout. It was only once the impetus given by *The Big M* schedule was appreciated that a space emerged for BN's creative practice to have a key role.

3.2 Making souvenirs

We now consider how BN's creative practice addressed the challenges and opportunities of *The Big M*, with ISIS Arts' audience evaluation objectives and the broader possibilities offered by materialising public responses to *the artwork*. To contextualise our analysis, we first describe what was made at a particularly dense point in the project and four threads of interest reflected in these artefacts according to BN's and JB's discussions.

3.2.1 The Domes and their assembly

In response to partner discussions and *The Big M*, BN designed three customisable souvenirs and a system for producing them comprising of a cutter-plotter linked to a computer with relevant software, placed on a table outside

The Big M's exit to catch the flow of visitors leaving the exhibition. BN was present to facilitate visitors' creation of personalised souvenirs through software that generated unique shapes (see Figure 4).

One particular souvenir, the *Dome*, consisted of five partially pre-fabricated 2D elements (Figure 3). It was assembled by sandwiching three card layers (including two personalised layers), folding and tearing cut-out images in the top layer, and folding an acetate layer over to slot into all layers holding them together to create a three-dimensional enclosure.

To make a *Dome* after leaving the exhibition, a visitor would describe their response to *the artwork* by moving sliders in a software application relating to predefined ambiguous terms that were derived from questionnaires previously designed and deployed by BN. In view of the visitor, the generated forms were then converted by BN into a file compatible with the cutter-plotter and the personalisable layer was placed into a card template that was loaded into the cutter-plotter, which would then cut-out the central section of the

Figure 3 The Dome *souvenir and its components.*

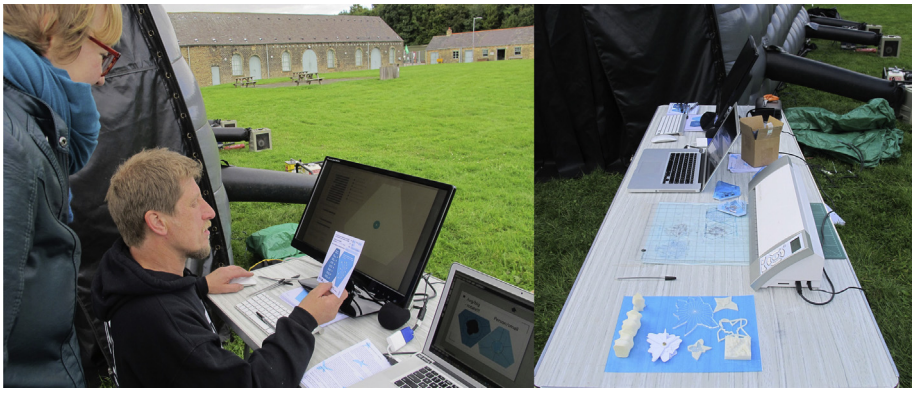

Figure 4 The system for creating the Dome *souvenir outside* The Big M.

layer according to the visitor's slider inputs. The same process cut out a smaller central section of the third layer according to an amalgam of previous visitors' responses. Image cut outs were then folded upward if the visitor had watched the corresponding video section, or torn off if not. The visitor could then self-assemble their *Dome*, although many asked BN to help – sandwiching the four cardboard layers by folding and securing the acetate enclosure in place.

3.2.2 Attending to project collaborators and context

The appearance of the *Dome* souvenir evoked *The Big M* exhibition space (the 3D form) and *the artwork* (the cut-out images), and was created outside of the exhibition itself in response to visitors' evaluation of *the artwork*. These design considerations demonstrate BN and JB's sensitivity to the interests and requirements of the other collaborators and the particular context of *The Big M*.

The design also reflected a response to certain constraints imposed by the exhibition – the pre-dictated schedule (of pop-up exhibitions) around which the souvenir-making activity had to be coordinated. Further, *the artwork* itself was not available for manipulation within the souvenirs (CG, quoted above). So, the *Dome* design needed to work in conjunction with visitors' viewing of *the artwork*, and to complement it.

BN and JB also voiced their considerable attentiveness to the "*context that arts organisations operate in*", (organisations such as ISIS Arts often must evaluate public responses to demonstrate their impact for funders, see also CG quoted above), "*all that accountability stuff*" (JB). For example, BN talked to other arts organisations and the UK Arts Council to "*get an idea of the context*." An understanding of context was further developed through the use of questionnaires based on ISIS Arts' feedback forms, which then directed future design work "*in ways that would seem relevant and interesting to ISIS Arts*" (JB). In one questionnaire, direct links were made to questions raised by *the artwork* such as 'How close to the precipice are we?', so that BN could draw upon "*a central metaphor of [the artwork]*" (BN) for inspiration.

The connection that BN and JB wanted to make with *The Big M* was also underwritten by CN's experience of it at *the artwork* preview.

3.2.3 Audience responses as shapes for reflection

In the final system design, personal souvenirs were created that encapsulated visitors' ratings of their experiences against twelve descriptors translated into 2D shapes. This reflected BN's and JB's emerging interest in using audience responses to create shapes that prompted their further reflection (see Figure 5).

BN translated an initial aim of "*getting data and trying out questions*" (JB) into two questionnaires deployed at early showings of *the artwork*: one based upon

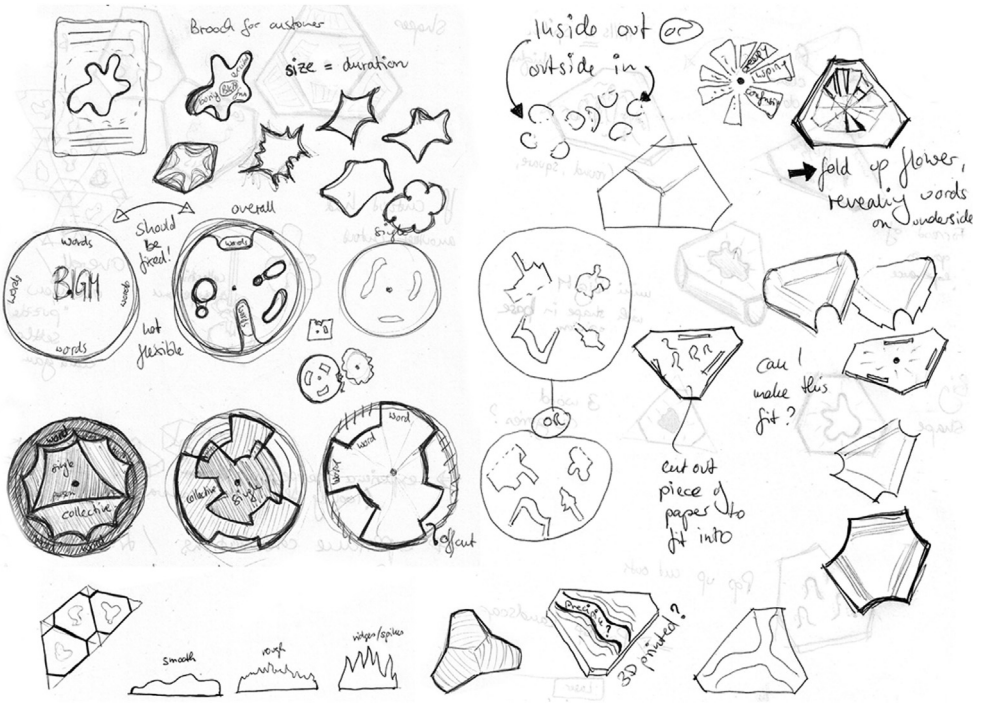

Figure 5 A sample of BN's sketches exploring forms derived from initial audience data

a feedback form used by ISIS Arts, another using more open questions. BN used responses to the latter to suggest descriptors against which future visitors could rate their experience (e.g. weird, calm, inspiring, eye-opening), and explored how such ratings could be translated into 2D material forms using a cutter-plotter or printer (e.g. stencils, cut-outs). Throughout BN's and JB's discussions it is clear that questionnaires "*were a means to get shapes, shapes were to have significance in this interactive fabrication session … a means to engender people's reflection on what they were doing*," (JB) rather than being regarded as a simple representation of their opinions and experience as might be typical of arts organisations' public impact surveys. Their emphasis was on gathering data that was useful in making distinct and different shapes, ensuring that the descriptors chosen were open to interpretation to ensure variability in the shapes produced. Early proposals for data materialisation also prompted BN and JB's discussion of what such objects were – rather than representations of people's reactions to *the artwork* they were occasions for discussion and reflection.

3.2.4 Materialising data in 3D

Design explorations oriented to "*giving a materialisation to the data*" (JB), in keeping with BN's research interest to create three-dimensional artefacts from digital data. The final *Dome* souvenir had elements that represented digital

data (visitors' responses) and was three-dimensional. This was recognised by JB who characterised BN's research as involving "*objects as extensions of digital processes*" produced within shared activities with the visitors. In contrast with earlier proposals for tracking visitors' movements, JB saw academic research novelty in this perspective.

This shift in emphasis from objects to activities added practical concerns for how three-dimensional objects could be made in real-time on site with *The Big M* (JB): explorations of what could be made quickly using a 3D-printer were unsatisfactory and prompted further consideration of a cutter-plotter and the use of pre-fabricated elements (see Figure 6).

3.2.5 Re-situating things in their making

A visitor to *the artwork* participates and is present in the creation of their *Dome* souvenir (answering questions in software, seeing the cutter-plotter in operation, assembling the artefact). This reflects BN and JB's broader research interests in considering artefacts *through* their making, which intertwined throughout the project.

In reference to their sketchbooks and notebooks, BN and JB recalled how, at their first meeting, BN diagrammed relationships between an object and its making/fabrication, and JB drew an interpretation of this that linked experience and "*getting involved in making (not just an encounter with something readymade)*" (see Figure 7 where BN and JB show their 'parallel' thinking.). Subsequently, BN and JB continued to discuss the linkage between artefacts and their "*fabrication in activities as a real-time affair*," drawing on JB's

Figure 6 BN's explorations in different materials, shapes, and fabrication technologies being discussed at a supervision meeting.

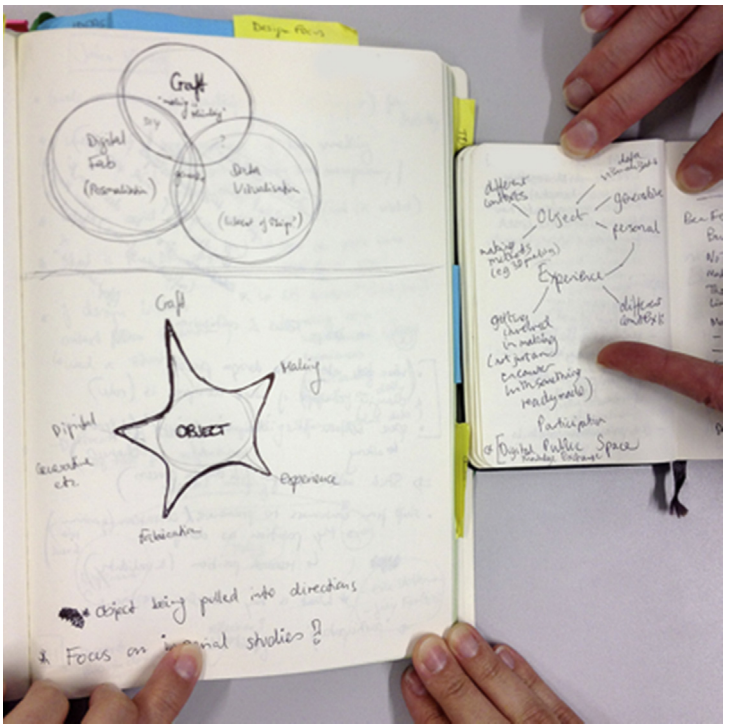

Figure 7 BN's (left) and JB's (right) notes from May tutorial meetings

long-term interest in "*re-situating things in terms of the activities that made them*" and his absorption of anthropologist Tim Ingold's ideas about making. JB read from his notes: "*The souvenir as a thing not an object*", "*embedding fabrication of things in activities. The radicality of this with respect to received ideas of fabrication*". Significantly, BN and JB recounted, souvenirs then became about "*creating memorability through activities … memorability not just because of the thing*", which implied "*staging and performing fabrication*" and a shift in aesthetics from objects to activities with corresponding technological implications.

The need identified by BN and JB to ensure that souvenir-creation formed part of an exhibition visit fostered a practical concern for rapid and engaging fabrication on site, which combined with other practical concerns for visual correspondence to *The Big M* and materialising data that BN had been exploring via the physical form of souvenirs and their customisation according to visitor's responses. A meeting between BN, JB and two other PhD supervisors helped BN resolve these concerns into a coherent design. BN had used layers of cut cardboard to create initial souvenir prototypes, and JB recalled discussing how souvenirs may then be distinguished as several components ("*a base*, *an enclosure*, *items within the enclosure*") relating to audience responses in different ways. Secondly, they discussed how some of these elements could

be pre-fabricated (where data was not "*fast changing or idiosyncratic*"), others made in real-time (data specific to visitor). BN brought these ideas together in her sketchbook (see Figure 8), visualising how an artefact closely resembling the *Dome* souvenir to-be could integrate cut-outs to be fabricated on site (variable visitor data) and pre-fabricated enclosure/structural elements (providing a visual resemblance to *The Big M*), and how individual and collective visitor data could correspond to particular elements. BN also recalled how the assembly of such an artefact would also have the desired element of performance.

3.3 *Designer's creative practice within* On the Precipice

Overall, the collaborators valued BN's design work: "*[BN] really understood what we were trying to do and the ethos of our organisation*" (CG); "*she managed to marry together some quite complicated questions, about people's emotional responses to the exhibition, with a good quality artefact*" (CN). EC considered the souvenir design work "*a very nice project*," whilst, as we shall note, being circumspect about wider impacts. However, BN's design process only became clear to ISIS Arts through succeeding encounters with what was made, as CG's account illustrates, next.

3.3.1 *Artefacts for inspiration not evaluation*

BN's questioning of visitors was not initially welcomed by ISIS Arts who, as CG describes, considered BN's questionnaires to be "*something that we'd said*

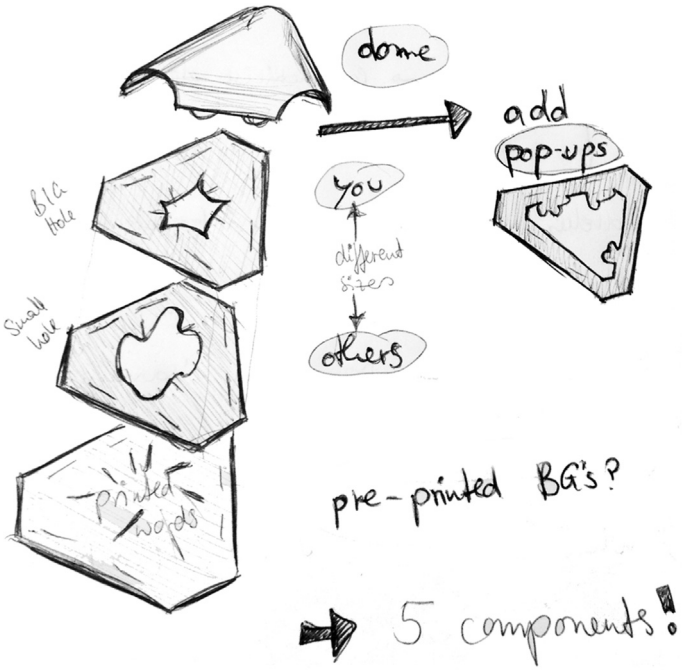

Figure 8 BN's sketch of the layered construction of the Dome *souvenir*

that we didn't want because we were quite explicit in saying that we don't want an evaluation that we hand out." CG further explains that "*[the Big M] being in a park where people are just wandering through, it felt like a little bit of an invasion*" and notes the practical difficulties of administering questionnaires on-site. This response helped BN and JB refine the purpose and form of the questionnaires, as BN recalled: "*The questionnaires I was doing were trying to figure out what data we can get from audiences to then use for a souvenir*." BN's subsequent questionnaires began to demonstrate to ISIS Arts that they were a *means* rather than an end, "*she'd totally reworked the questionnaire. We were like*, '*Oh okay, it's a process that we're seeing that this is developing now*,' *but perhaps still not totally aware that she was conducting it as research to develop the souvenir*" (CG).

CG selected BN's first deployment of a souvenir-creation system as a defining moment, "*in seeing how we were moving forward*." For CG, it became clear that "*these prototypes were what we'd been working towards without perhaps realising*." In many respects, then, the existence of artefacts enabled CG to retrospectively formulate her initial interests.

3.3.2 Appreciation and potentialities

Much of the collaborators' appreciation of BN's work was accompanied by formulations of the applicability and consequences of this work in their own contexts. For CG (and ISIS Arts), this was how the use of bespoke souvenir-creation could enable audience development by going beyond understanding audience experience to engaging new audiences: "*We're really happy with the outcome […] we wanted to capture the depth of experience and actually creating a process that not only captured that but also deepened the experience is more important I think for us*."

In contrast, EC was more cautious about whether or not the project would create tangible benefit: "*in terms of it being a research project […] how has the outcome changed ISIS Arts' work in practice? […] Is the work getting to more people? Are more people engaging with it?*" CN was similarly "*not sure we have impacted in the right way […] on industry*," but recognized that "*valuable knowledge exchange has occurred, [that has] benefitted me*."

CN's especially appreciated observing BN's practice: "*I really admired her capacity for not making that decision in advance, and actually being prepared to go into each stage ready to learn more about what she wanted to do […] that it is possible to not have the end in mind, and not panic*." CN also recognised BN's use of making as inquiry: "*she would prototype something, she'd evaluate it, and from that she hoped that the next step would emerge quite naturally*." CN described how he had applied this learning to his own work: "*the idea of a physical souvenir, which in some way represents an experience, but which is*

also a satisfying tactile engaging piece of art is very cool. So I've undoubtedly dropped that in to various tangentially related projects …"

4 Discussion

Our analysis of *On the Precipice* unpicks some of the complex dynamics at play in academic-industry collaborations. The project was deemed largely successful by those involved. The souvenir-creation system and the process of designing it enabled collaborators to explore novel possibilities that they would not have considered otherwise: for CG, experience materialisation as audience engagement; for CN, an open and emergent approach to design. This exploration produced learning and benefit.

Returning to the objectives of our study, we now consider how BN's creative practice addressed the challenges of *On the Precipice* as a complex, interdisciplinary and cross-sector collaboration, and how she produced outcomes that were deemed successful by most collaborators. We also discuss how such an approach could be applied in similar academic-industry collaborations, conceptualised as 'creative exchange'.

4.1 The value of designers' creative practice in complex collaborations

4.1.1 Managing complexity through creative practice

Threads of interest overlapped and entangled, and creative practice was often a means of understanding and revealing this complexity. Several concerns were aligned via a unifying design principle proposed at one of BN's supervisory meetings (layered souvenirs combining pre-fabricated elements and elements created with the visitor). But BN used making leading up to and following this discussion – explorations in forms and means of data materialisation, representations of precipices etc. Noteworthy in BN's and JB's accounts is that the complexities of the project context were addressed in and through their *creative practice* and the inquiring *making* within it.

Much of what BN and JB discussed related to how they chose to frame design challenges within the project according to the specifics of the context and their own research interests, and the practical and creative implications that arose from these choices (e.g. concerns about 'making on the spot' as implications of re-situating souvenirs in their making within an exhibition experience). Dorst (2011) suggests that such development and adoption of frames is an appropriate strategy for dealing with "open, complex problems" that necessitate abductive reasoning. Others have similarly suggested that designerly strategies (such as problem-framing as described above) are particularly, if not uniquely, suited to dealing with ill-defined or wicked problems (Cross, 2007; Forlizzi, Stolterman, & Zimmerman, 2009; Gaver, 2012; Stolterman, 2008).

This collaboration presented a complex setting for design work, which may have presented *wicked* problems (Rith & Dubberly, 2007; Rittel & Webber, 1973). However, our analysis shows that BN and JB approached the collaborative project as a process of problem-formulation, where the nature of 'problems' (or even whether collaborators regarded them as such) was explored and refined through BN's creative practice, and that this led to novel and valuable results for collaborators (c.f. Callon, 1986). This observation challenges simplistic conceptions of design as problem-solving and emphasises the creative value of problematisation. Cross (2007) observes that designing in general can be characterised in this manner, which is to treat "given problems *as though* they were ill-defined problems, for example, by changing the goals and constraints, even when they could have been treated as well-defined problems".

4.1.2 Context as a creative constraint

The constraints of *the artwork*, *The Big M* and the requirements of arts organisations such as ISIS Arts were found by BN and JB to be constructive in shaping their creative practice. For BN and JB, constraints provided framings for the design work that suggested avenues for exploration and subsequent design tasks. Constraints had *creative value*; they were not (necessarily) restrictive to design practice.

Further, BN selected which constraints to attend to according to those that would be most useful in generating design inspiration and developing concepts. For example, considering the accountability of arts organisations suggested the use of visitor questionnaires within the souvenir-creation process, but questions were devised to enable the generation of distinctive and different data rather than as part of an evaluation exercise.

Our findings parallel Cross' (2007) observations of skilled designers who "explore the problem space from a particular perspective in order to frame the problem in a way that stimulates and pre-structures the emergence of design concepts". Designers' choice and use of constraints is then an exercise in problem-setting, which "is not only the act of proposing a new framing, but the whole process whereby you test it and refine it, so as to make it useful" (Gedenryd, 1998). Such problem-setting or *problematisation* serves an inquiry into what can or should be designed and constraints have *instrumental* value within this activity (Dorst, 2011).

4.1.3 Novelty from alternative problematisations

The problematisations that BN and JB developed, through their creative practice, related to their own broader concerns *in addition to* responding to the particular characteristics of *The Big M* and ISIS Arts' needs in respect to it. Rather than being a distraction, this was another source of value for the

collaborators. BN designed a system that developed her interests in re-situating things in their process of making and materialising data in 3D, through which participants were encouraged to explore and understand a new space of possibilities (as offered by personalised souvenir creation) and thereby identify unexpected and valuable applications. In *On the Precipice*, ISIS Arts recognised that the fabrication of souvenirs offered a means for public engagement beyond mere visitor feedback (although may not have appreciated BN's and JB's interest in re-situating things in their making).

Through orientating to creative practice as a form of *personal inquiry* (Gedenryd, 1998), designers can provide alternative problematisations of the task in hand that both progress design work where multiple agendas are difficult to reconcile and, through what is designed, extend *collaborative inquiries* into new territory to identify novel and valuable ideas. The above aspects emphasise the value that BN brought to the project as a professional designer, but have implications for how collaborators less familiar with such designerly ways of working contribute to the joint endeavour.

4.2 Creative practice in participatory projects

BN undertook much of the creative thinking and all the making in the project. Whilst partners raised few issues about this configuration of responsibilities, in participatory projects seeking to involve those affected by what may be designed (Ehn, 1993), this configuration might be perceived as a power imbalance in the designer's favour. Through participatory design and related approaches, equality has become a guiding value for collaborative design work. However, asymmetrical participation in creative activities need not imply an unequal collaboration and recent discussions of participatory design have recognised the creative value of such *difference*.

McCarthy and Wright (2015) discuss the importance of "dialogically productive distance" (McCarthy & Wright, 2015, p 85) in participative projects, where participants recognise each other as differently placed yet equal. McCarthy & Wright discuss how participants' agency in collaborative work is directly related to difference, where participants' authority comes from voicing concerns according to their personal and professional identities. From this perspective, for some, adopting the role of 'maker' could reduce the authority of their contributions.

For Binder et al. (2011), design has shifted from the production of artefacts to the creation of *things* — sociomaterial assemblages of human and non-human actors that make matters of concern available for agonistic debate. For these writers, (participatory) design then becomes the performative staging of *design things* which raises questions about how the object of such work can be experienced, manipulated, and made into a "public *thing* that is open to

controversies among participants in the project as well as those outside" (Binder et al., 2011, p 160, their *emphasis*).

In the case herein, BN's design work ensured that a prototype system that explored collaborators' multiple interests was built, deployed and analysed within the available project time and within the constraints of *The Big M* and *the artwork* programme. Through this work the project aims were concurrently formulated and addressed. Therefore, BN's creative practice should not be characterised as being in opposition to the collective concerns of the project, nor was her principal ownership of the making a denial of the different but equally important contributions that other participants made with respect to their different concerns and expertise. Instead, BN's creative practice can be understood as a form of "design thinging" (Bjögvinsson, Ehn, & Hillgren, 2012) that respects the particular voices (McCarthy & Wright, 2015) that individuals bring to collaborations. We offer our case as a complex picture with dissensus in the frame, as an alternative to models of participation that emphasise creative parity.

4.3 Academic-industry collaboration through creative exchange

BN's creative practice was valuable for collaborators in dealing with the complexities of the project and producing novel outcomes through alternative problematisations. Hence, creative practice *as a pragmatic inquiry into what might be* can be a particularly productive approach for academic-industry collaborations which extends transactional models of cross-sector collaboration typically described as Technology Transfer, Knowledge Translation, and Knowledge Exchange (Hagen, 2008) *through the formative role of creative practice*. We call this approach to collective participation '*creative exchange*' and, elsewhere (Bowers, Bowen, & Shaw, 2016), discuss how such collaborations should be considered in terms of multiple makings of problematisations, enrolments, and infrastructures. Herein, we return to consider creative exchange as a means of design participation.

Drawing from a broad literature review, Vines et al. (2013) characterise the goals for participation as the *sharing of expertise through boundary objects*, which is evident in *On the Precipice* although what was made did more than "elicit knowledge, values and opinions" (Vines et al., 2013). BN generated potential solutions by seeing and acting upon an unfamiliar situation, drawing on her design repertoire (Schön, 1983), corresponding with the dynamic materials and experiences present (Ingold, 2013), and using constraints creatively in problem setting (Dorst, 2011). In so doing, the territory for design exploration was broadened through *creative practice* responding to participants' expertise, and unexpected and relevant possibilities were identified.

Vines et al. (2013) also highlight *sharing control with users* as a principal motivation for 'user' participation in design processes, and suggest an important distinction is the extent to which participation is *witting* – with awareness of project and design goals and how participants can influence them. From pre-project discussions for *On the Precipice*, industry and academic partners expected to collaborate on the design of digital tools that would be built by others and were able to have "a substantive say in what the outcome was" (Carroll & Rosson, 2007) through encountering BN's deployed prototypes. In the project reported here, frequent opportunities to encounter and influence BN's creative practice ensured that collaborators' participation was *witting*.

5 Conclusion

In this paper we have described our empirical study of *On the Precipice* to demonstrate the value of *designers' creative practice* in complex collaborations, and how such design practice supports *creative exchanges* that generate benefit in academic-industry collaborations.

Our study focussed on a single collaborative project. We recognise that connections between people, their interests and the work that they contribute may extend before and after the project timeframe and are not limited by the scope of the project itself. After *On the Precipice*, for example, BN has continued to develop her research interest in materialisation as "physical data translation" through creative practice in diverse projects (Nissen & Bowers, 2015). This subsequent work is then inevitably influenced by what has gone before.

The configuration of BN's creative practice within *On the Precipice* exemplifies one particular form of *creative exchange*. Elsewhere in our research programme we are seeing other configurations of creative practice and collaboration. A principal value of creative practice within such participative projects is arguably the ability to envisage and explore alternative possibilities, which the designerly ways of thinking and doing familiar to skilled designers enables.

Studying *On the Precipice*, set in the context of the broader research programme, suggests to us that overly simplistic ideas of effective project organisation, democratic participation, and the relationship between individual and collective creative work should be resisted. Rather we should study and learn from the complex and dynamic configurations that can pragmatically emerge as creative work is done. We offer the current case as an example of a certain form of creative practice productively creating not just artefacts but also a set of relationships between stakeholders in which creative exchange can take place.

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Notes

1. http://www.saturateapp.com/.

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